



Riparian Raptors on USACE Projects: Bald Eagle (*Haliaeetus leucocephalus*)

The bald eagle (Figure 1) is one of four raptor species included in a series of Engineer Research and Development Center (ERDC) technical notes produced under the Ecosystem Management and Restoration Research Program (EMRRP). These technical notes (ERDC TN-EMRRP-SI-(12-15)) identify riparian species potentially impacted by U.S. Army Corps of Engineers (Corps) reservoir operations. For management purposes, these raptors are considered riparian generalists because they inhabit the riparian zones surrounding streams and lakes of Corps projects but may seasonally use adjacent transitional and upland habitats. The other raptors in this grouping are the osprey (*Pandion haliaetus*), peregrine falcon (*Falco peregrinus*), and red-shouldered hawk (*Buteo lineatus*), each of which is discussed in a separate technical note describing the ecology, legal status, potential impacts, and management guidelines for the species. These technical notes are products of the EMRRP work unit entitled "Reservoir Operations - Impacts on Habitats of Target Species," and are linked to ERDC TN-EMRRP-SI-11, which describes the function of the work unit and general status, impacts, recovery, and management of these four riparian raptors on Corps projects.



Figure 1. Bald eagle (Photo by Les Turner)

DISTRIBUTION: Bald eagles once ranged throughout most of North America from Alaska to eastern Canada, and south to California, Arizona, Texas, and Florida (Johnsgard 1990, U.S. Fish and Wildlife Service (USFWS) 1991). Major breeding populations of northern bald eagles occur in Alaska, Canada, the Pacific Northwest (Washington, Oregon), and the Great Lakes Region, with the southern bald eagle breeding primarily in Florida and the Chesapeake Bay Region (Maryland, Delaware, and Virginia) (Figure 2). Small local breeding populations exist along the Gulf Coast of Texas and Louisiana and along the Mississippi River, with a few widely scattered pairs in other states (Clark and Wheeler 1987). Large winter concentrations of bald eagles in the United States are found along the Chilkat River in Alaska, in the Klamath basin in Oregon, along the upper Mississippi River, and in the Chesapeake Bay area.

STATUS: In the late-1700s, bald eagle populations were estimated to have numbered between 25,000 and 75,000 individuals within the continental United States, and perhaps as many as half a million throughout North America. An estimated 100,000 individuals were destroyed by sportsmen and landowners between 1917 and 1953 (Stalmaster 1987). Public awareness of the eagle's plight helped bring about the passage of the Bald Eagle Protection Act in 1940. However, with the subsequent increased use of pesticides such as DDT, bald eagle populations continued to decline. By 1963, only 417 breeding pairs remained in the lower 48 states. After passage of the Endangered Species Act (1973), the bald eagle was listed as endangered in March 1978 in all states except Washington, Oregon, Minnesota, Wisconsin, and Michigan, where it received threatened status. In

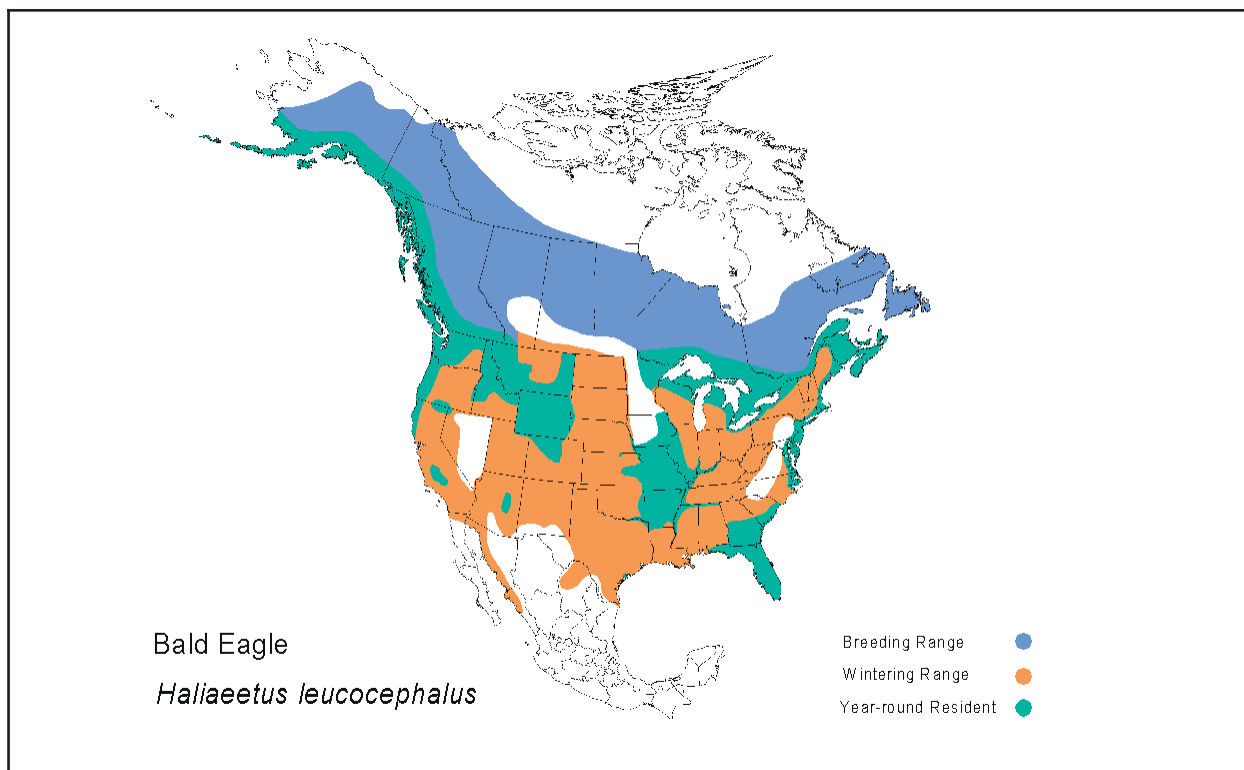


Figure 2. Range of the bald eagle in North America and Mexico

1982, ten years after the ban of DDT, nesting success of bald eagles had increased to 65 percent. The bald eagle was reclassified from endangered to threatened throughout the 48 conterminous states in 1995 (Federal Register, 12 July 1995). Currently, approximately 5,800 breeding pairs exist in the lower 48 states, and on July 6, 1999, the U.S. Fish and Wildlife Service proposed complete removal of the bald eagle from the Endangered Species List (American Bird Conservancy 1999). If delisted, the species will continue to be protected under the Bald Eagle Protection Act, Migratory Bird Treaty Act, and Lacey Act.

HABITAT: The bald eagle is primarily associated with riparian zones, and birds generally nest proximal to the bodies of water where they feed (USFWS 1996). Nearly 100 percent of successful eagle nests in the United States are within 2 miles (3.2 km) of open water, and most are less than 0.5 mile (0.8 km) from a river, lake, coastal area, or open bay (fresh and marine) (Green 1985). Successful nests are most often located in trees that provide a clear view of the surrounding area, have an unrestricted flight path on one side, and are strong enough to support the massive nest. Preferred nesting areas are usually found in open-canopied, mature, old-growth stands (Anthony et al. 1982; Mathisen 1983). In the southeastern United States, most nests are constructed in dominant or codominant pines (*Pinus* spp.) or bald cypress (*Taxodium distichum*) (USFWS 1996). However, nest trees are often located in open discontinuous forest stands, along ecotones, or in open fields and pastures, but are rarely located immediately adjacent to a shoreline (McEwan and Hirth 1979; Andrew and Mosher 1982). Nests may be built 140 ft (43 m) off the ground, but most are 35 to 66 ft (10.6 to 19.8 m) high. They are large, flat-topped structures, weigh hundreds of pounds, and are usually built in the tops of living trees (USFWS 1991). Nests are usually used for many years, with new material being added each year. Construction materials include sticks, limbs, and grasses and

linings of sod, down, seaweed, or Spanish moss (*Tillandsia usneoides*). Wintering bald eagles are most often associated with riparian and open-water areas that provide an ample food supply and have adequate nocturnal roost sites (USFWS 1983). Bald eagles spend a large portion of winter in more terrestrial, inland habitats hunting small prey and scavenging dead livestock and wildlife (Platt 1976, USFWS 1983). Communal roosts are important focal points of winter activity and are used repeatedly for many years. Roost trees are large with open branching and strong horizontal limbs and are usually located in areas protected by vegetative cover and topography. Diurnal roosts are also important winter habitat components. Trees, logs, driftwood, gravel and mud bars, riprap, ice, power-line poles, fence posts, and pilings are used as perches (Stalmaster 1987). Dead trees are used more often than live trees, and perch selection is based primarily on availability of an abundant food source. Since fish are a large part of the diet, perches are located near water and provide an unobstructed view of the surrounding area (Steenhof 1976).

BEHAVIOR: As winter arrives on more northerly breeding sites and lakes and rivers begin to freeze, bald eagles migrate to open-water habitats, particularly coastal areas. Stimulated by weather, photoperiod, and a shrinking food supply, thousands of eagles move south from central Canada into the United States from November through March. Populations breeding in the Great Lakes region often winter along the Mississippi River in Missouri and Illinois. Eagles in the far north and extreme south may remain in their nesting areas year-round (USFWS 1983, Stalmaster 1987). Mabie, Merendino, and Reid (1995b) found that 138 bald eagle nestlings banded in Texas moved northward to a broad area between the Rocky Mountains and the Mississippi River Valley that extended north into Canada. That some individuals remained in Texas or moved to the Atlantic Coast during the breeding season suggests that bald eagles fledged in Texas may enter breeding populations in the southern United States. Home range varies from 1,700 to 10,000 acres (680 to 4,000 ha), depending upon season and food availability. Eagles are fairly long-lived in captivity (≤ 48 years) but probably survive no longer than 30 years in the wild (Green 1985).

REPRODUCTION: Bald eagles are monogamous and usually mate for life, but cases of remating have been observed. Individuals become sexually mature in 4 to 6 years and often do not nest until their fifth or sixth year. Eagles usually return to breed on their natal site, which may extend 160 miles (259 km) from where they were hatched (USFWS 1983; Green 1985). Within the United States, nesting activity begins as early as September (Florida) or as late as May (Alaska and Canada), with both sexes sharing in nest repair and construction. Females usually lay a single clutch of 1 to 3 buff-colored, speckled eggs (Green 1985). Eggs hatch in 34 to 38 days, and young fledge in 9 to 14 weeks after hatching. Parental care continues for 4 to 6 weeks after fledging, with both parents caring for the young. Aggression between siblings is often severe and fratricide is common (The Nature Conservancy 1992). Young birds are dependent on their parents for 60 to 80 days after fledging until they are fully capable of hunting. Mortality is high in fledglings; approximately 50 to 70 percent die within a year (Green 1985; Swenson, Alt, and Eng 1986).

FOOD HABITS: Food habits vary depending on region and season, but diet most often includes fish, water birds, and carrion (Swenson, Alt, and Eng 1986; Mabie, Merendino, and Reid 1995a). While fish and waterfowl occupy the major portion of eagle diets (Todd et al. 1982; Dugoni, Zwank, and Furman 1986; Swenson, Alt, and Eng 1986), bald eagles are opportunistic feeders and may take any vertebrate prey, either alive or as carrion. As winter progresses and lakes and streams freeze over, eagles switch from fish to waterfowl (Dunstan and Harper 1975). In Yellowstone National

Park, 93 percent of eagles fed largely on ungulate carrion during the winter (Swenson, Alt, and Eng 1986).

IMPACTS: Several factors have contributed to the decline of the bald eagle during the last century. Indiscriminate killing (e.g., shooting, trapping), habitat loss, and encroachment were the major threats before the mid-1940s (Howell 1941). Uninformed fishermen, ranchers, farmers, and hunters killed many bald eagles prior to the passage of the Bald Eagle Protection Act. After the mid-1940s, widespread use of the pesticide DDT resulted in a decline in reproductive success of bald eagles. Environmental pollutants such as mercury, lead, and polychlorinated biphenyls (PCBs) on or near wintering grounds affected eagle reproduction and distribution (Green 1985, Bowerman et al. 1994). Bald eagles have died from feeding on carrion treated with poisons (e.g., thallium, strychnine) used in predator control programs (USFWS 1983, Bortolotti 1984). Recently an avian disease, thought to be caused by a neurotoxin of unknown origin, has been implicated in the deaths of many bald eagles and American coots (*Fulica americana*) in the Southeast, primarily in the vicinity of DeGray Lake, Arkansas. This disease, which causes a signature lesion in the brain and spinal cord of affected birds, is known as “Avian Vacuolar Myelinopathy” (AVM) (U.S. Army Corps of Engineers (USACE) 2000). Over 50 bald eagles and hundreds of coots are believed to have died from AVM. However, loss and degradation of habitat remains the largest obstacle to maintaining and increasing viable bald eagle populations. Land-use practices (e.g., logging, construction, recreational use) associated with development often degrade or destroy feeding and nesting sites and are usually accompanied by an increase in human activity (e.g., workers, recreationists, vehicle use) (Gende et al. 1998). Power lines also constitute a significant source of mortality to both bald and golden eagles (*Aquila chrysaetos*), with perhaps hundreds being electrocuted each year (Williams 2000).

MANAGEMENT: A top priority for management is to determine where and when bald eagles use habitats at specific locations. Once locations are identified, maintenance of large mature riparian forest stands that provide suitable trees as nesting sites should be a priority on the breeding grounds or areas where eagles are known to have previously bred. Nest and snag trees can be provided by preserving 4 to 6 mature trees and 4 to 6 large over-mature, broken-topped, or dead trees for every 320 acres (130 ha) of forested land within 0.25 mile (0.4 km) of open water (USFWS 1983, 1991). The use of artificial platforms does not appear warranted for eagles in the Southeast. The area around nesting sites should be protected, and human activity should be restricted. However, tolerance of eagles to human disturbance is often dependent on region, past history, and timing. Eagles are most susceptible to disturbance in the period before and during courtship, egg laying, and incubation. Identification and protection of suitable habitat for future population expansion is important, especially for maintaining population viability in particular localities. Hacking is a successful technique for reintroduction and may still be needed to enhance small populations. Factors to be considered in the management of breeding areas include total amount of suitable nesting habitat available in an area, extent to which an area is used by nesting eagles, number of pairs using an area, and current or planned land-use activities.

Habitat use during winter varies considerably, since birds are less faithful to territories during this season. Movement of birds from northern breeding areas may change yearly depending on abundance of food on the breeding grounds (i.e., they may choose to winter on areas where they bred). Winter habitat management should be designed to maintain and improve the suitability of wintering areas known to be historically important to eagles. The U.S. Geological Survey (USGS)

sponsors annual nationwide winter surveys of bald eagles. Usually conducted by state or federal personnel, this standardized survey helps to establish an index of the wintering bald eagle population and seeks to identify previously unknown areas of wintering activity (USGS 1998). Site-specific management plans can be developed after determining the locations and approximate numbers of eagles inhabiting the sites. Communal roosts, focal points of activity during winter, may be used by large numbers of birds for many years (Green 1985). Roost trees are large, over-mature trees associated with feeding areas. Roosts and feeding areas should be identified and clearly marked to avoid disturbance by human activities. The USFWS (1983) recommended a 1,320-ft (400-m) buffer zone around feeding areas. These areas should be documented, referenced on base maps, and put into long-term management programs to ensure their continued existence. Management plans should include provisions for (1) protection and retention of trees used as hunting and resting perches, (2) protection of physiographic features that screen/buffer feeding areas from disturbance and the elements, and (3) restriction of livestock use around feeding areas. Exposed-bait furbearer trapping should also be prohibited.

PHOTO CREDIT: Bald eagle. Photo and all copyrights belong to Mr. Les Turner. Permission for use of photo by Jim Elliott, Director, South Carolina Center for Birds of Prey.
<http://www.charleston.net/org/sccbp>

POINTS OF CONTACT: For additional information, contact Dr. Wilma A. Mitchell (601-634-2929, mitchew@wes.army.mil), Mr. Chester O. Martin (601-634-3958, martinc@wes.army.mil), or the manager of the Ecosystem Management and Restoration Research Program, Dr. Russell F. Theriot (601-634-2733, therior@wes.army.mil). This technical note should be cited as follows:

Guilfoyle, M. P., Evans, D. E., Fischer, R. A., and Martin, C. O. (2000). "Riparian raptors on USACE projects: Bald eagle (*Haliaeetus leucocephalus*)," *EMRRP Technical Notes Collection* (ERDC TN-EMRRP-SI-12), U.S. Army Engineer Research and Development Center, Vicksburg, MS. www.wes.army.mil/el/emrrp

REFERENCES

- American Bird Conservancy. (1999). "Bald eagle proposed for de-listing," *Bird Calls* 3, 1.
- Andrew, J. M., and Mosher, J. A. (1982). "Bald eagle nest site selection and nesting habitat in Maryland," *Journal of Wildlife Management* 46, 382-390.
- Anthony, R. G., Knight, R. L., Allen, G. T., McClelland, B. R., and Hodges, J. I. (1982). "Habitat use by nesting and roosting bald eagles in the Pacific Northwest," *Transactions of the North American Wildlife Natural Resource Conference* 47, 332-342.
- Bortolotti, G. R. (1984). "Trap and poison mortality of golden and bald eagles," *Journal of Wildlife Management* 48:1173-1179.
- Bowerman, W. W., IV., Best, D. A., Giesy, J. P., Jr., Kubiak, T. J., and Sikarskie, J. G. (1994). "The influence of environmental contaminants on Bald Eagle (*Haliaeetus leucocephalus*) populations in the Laurentian Great Lakes, North America." *Raptor Conservation Today. Proceedings of the IV World Conference on Birds of Prey*. B. U. Meyburg and R. D. Chancellor, ed., Pica Press, London, 703-707.
- Clark, W. S., and Wheeler, B. K. (1987). *A field guide to hawks*. Houghton Mifflin, Boston, MA.
- Dugoni, J. A., Zwank, P. J., and Furman, G. C. (1986). "Foods of nesting bald eagles in Louisiana," *Raptor Research* 20, 124-127.

- Dunstan, T. C., and Harper, J. F. (1975). "Food habits of bald eagles in north-central Minnesota," *Journal of Wildlife Management* 39, 140-143.
- Gende, S. M., Willson, M. F., Marston, B. H., Jacobson, M., and Smith, W. P. (1998). "Bald eagle nesting density and success in relation to distance from clearcut logging in southeast Alaska," *Biological Conservation* 83, 121-126.
- Green, N. (1985). "The bald eagle." *Audubon Wildlife Report*, R. L. Di Silvestro, ed., National Audubon Society, New York, NY, 509-531.
- Howell, J. C. (1941). "Comparisons of 1935 and 1940 populations of nesting bald eagles in east central Florida," *Auk* 58, 402-403.
- Johnsgard, P. A. (1990). *Hawks, eagles and falcons of North America*. Smithsonian Institution Press, Washington, DC.
- Mabie, D. W., Merendino, M. T., and Reid, D. H. (1995a). "Prey of nesting bald eagles in Texas," *Journal of Raptor Research* 29:10-14.
- Mabie, D. W., Merendino, M. T., and Reid, D. H. (1995b). "Dispersal of bald eagles fledged in Texas," *Journal of Raptor Research* 29, 213-219.
- Mathisen, J. E. (1983). "Nest site selection by bald eagles on the Chippewa National Forest," *Biology and management of bald eagles and ospreys*, D. M. Bird, ed., Harpell Press, Ste. Anne de Bellevue, Quebec, 95-100.
- McEwan, L. C., and Hirth, D. H. (1979). "Southern bald eagle productivity and nest site selection," *Journal of Wildlife Management* 43:585-594.
- Platt, J. B. (1976). "Bald eagles wintering in a Utah desert," *American Birds* 30, 783-788.
- Stalmaster, M. V. (1987). *The bald eagle*. Universe Books, New York, NY.
- Steenhof, K. (1976). "The ecology of wintering bald eagles in southeastern South Dakota," M.S. thesis, University of Missouri, Columbia.
- Swenson, J. E., Alt, K. L., and Eng, R. E. (1986). "Ecology of bald eagles in the Greater Yellowstone Ecosystem," *Wildlife Monographs* No. 95.
- The Nature Conservancy (TNC). (1992). "Element Stewardship Abstract - bald eagle (*Haliaeetus leucocephalus*)," The Nature Conservancy, Arlington, VA.
- Todd, C. S., Young, L. S., Owne, R. B., and Gramlich, F. J. (1982). "Food habits of bald eagles in Maine," *Journal of Wildlife Management* 46:636-645.
- U. S. Army Corps of Engineers (USACE). (2000). "Official Avian Vacuolar Myelinopathy Interagency Web Site," Vicksburg District, Vicksburg, MS. <http://www.mvk.usace.army.mil/od/odm/avm>
- U.S. Fish and Wildlife Service (USFWS). (1983). "Northern states bald eagle recovery plan," Washington, DC.
- U.S. Fish and Wildlife Service. (1991). "Bald eagle," *USFWS Red Book*. Washington, DC.
- U.S. Fish and Wildlife Service. (1996). "Bald eagle," *USFWS Red Book*. Washington, DC.
- U.S. Geological Survey. (1998). "Mid-winter eagle surveys," World Wide Web. <http://eagle.idbsu.edu/mwc.html>
- William, T. (2000). "Zapped!," *Audubon* 102 (Jan.-Feb.), 32-44.

NOTE: The contents of this technical note are not to be used for advertising, publication, or promotional purposes. Citation of trade names does not constitute an official endorsement or approval of the use of such products.

Table 1
Bald Eagle (*Haliaeetus leucocephalus*) State Protection Status¹

| State | Status | State | Status |
|---------------|-----------------|----------------|-----------------|
| Alabama | SP | Montana | SP |
| Alaska | | Nebraska | SE |
| Arizona | FT ² | Nevada | SP |
| Arkansas | FT ² | New Hampshire | SE |
| California | SE | New Jersey | SE |
| Colorado | ST | New Mexico | ST |
| Connecticut | SE | New York | ST |
| Delaware | SE | North Carolina | SE ³ |
| Florida | ST | North Dakota | SE |
| Georgia | SE | Ohio | SE |
| Hawaii | | Oklahoma | SE |
| Idaho | SE | Oregon | ST |
| Illinois | ST | Pennsylvania | SE |
| Indiana | SE | Rhode Island | FT ² |
| Iowa | SE | South Carolina | FT ² |
| Kansas | SE | South Dakota | SE |
| Kentucky | SE | Tennessee | ST |
| Louisiana | FT ² | Texas | ST |
| Maine | ST | Utah | ST |
| Maryland | SE | Vermont | SE |
| Massachusetts | SE | Virginia | ST |
| Michigan | ST | Washington | ST |
| Minnesota | SSC | West Virginia | FT ² |
| Mississippi | SE | Wisconsin | SC |
| Missouri | SE | Wyoming | SSC |

¹ The federally threatened status of the bald eagle takes precedence over state listings.

² State uses federal status as their designation.

³ Proposed state status is threatened.

FE= Federally endangered species

FT= Federally threatened species

SE= State endangered species

ST= State threatened species

SP= State protected

SSC= State species of special concern

WL= State watch list species (no state protection)